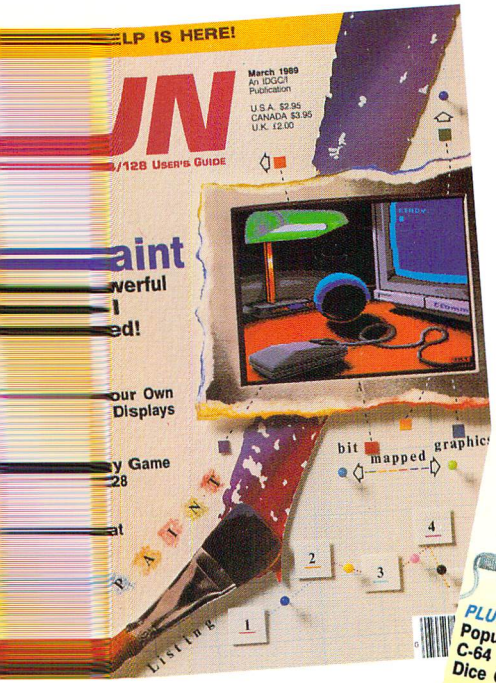
March/April 1989 Edition

RE RUN

RUN Programs on Disk

For the C-64 and C-128



: Extra Bonus Programs!

Introduction

March–April '89 ReRUN

WE AT ReRUN ARE DEDICATED to addressing the needs of the Commodore 64/128 users, especially when commercial software manufacturers' support of these machines is beginning to wane. I think the programs in this March–April 1989 edition reflect our positive commitment to you who are active in the home computer market.

First and foremost, we kick off this edition with RUN Paint, from our March issue, which we originally released on our RUN Works disk in the fall of 1988. Without a doubt, RUN Paint represents the most powerful, sophisticated graphics program ever published in a computer magazine. You'll find it gives you all the tools necessary to create dazzling screen images, using either a mouse or joystick in C-64 or 40-Column 128 mode.

I've also included on this disk several works of RUN Paint art created by James Hastings-Trew. Just activate RUN Paint's Med-Res mode from one of the drop-down menus and then load the med-res screens.

Kalah, another program from our March issue, is a 64- and 128-mode version of the ancient board game. Its object is to outwit your computer in capturing stones as you move counter-clockwise around the board. You begin by selecting from three skill levels and have your choice of starting with one through six stones per pit.

Many C-128 users also use IBM-compatible computers or may eventually complement their home computer systems with such a computer. With that in mind, we offer, from the April issue, The MS-DOS Connection, a C-128 program that allows your C-128 and 1571 disk drive to read and write to MS-DOS formatted disks.

What do you think a program called "Roll Them Bones" is all about? Believe it or not, it's a C-64 version of that popular dice game, Yahtzy. Regardless of its name, this top-notch version of Yahtzy permits one through four players and is a lot of fun to play.

The Multitasking Factor was written by the Commodore international community's guru, Jim Butterfield. It's a unique program

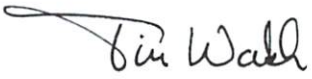
that keeps the computer busy calculating prime numbers whenever it's "idling" while awaiting input. Because the computer is seemingly performing two tasks simultaneously, it is emulating the more expensive multitasking computers.

When Lou Wallace, our resident telephone maven, last heard from pig farm tycoon Harold Bjornson, he didn't talk for long on the phone. Harold was busy in hot pursuit of Samantha, his 600-pound prize sow, who had been loose and was wreaking havoc in the chicken coop. Harold simply hollered he had just mailed us the remarkable C-128 machine language program, Amazing!, which is included on this disk. Lou said he heard what sounded like an angry snort and the phone went dead. Despite repeated attempts, we have been unable to reach Harold, but the Amazing! program and its accompanying documentation did reach us, and it is a truly inspiring piece of work.

As long as we're on the subject of pig farmer Harold Bjornson, *RUN*'s Associate Editor, Harold Bjornsen, strongly endorses Crabbie, the first of the two bonus programs on this disk. Plug a joystick into Port 2, boot up Crabbie on your C-128 in 40-Column mode and see if you can beat Harold's long-standing semi-pro high score of 27,390.

Finally, Kidnapped! is our second bonus program. It's a challenging, time-intensive game where the object is to round up all your kidnapped friends within a specified time. You'll have your work cut out for you.

Well, that does it for this ReRUN. Stay tuned two months from now for the next edition.



Technical Editor
RUN *magazine*

How To Load

Loading from Menu

To get started, C-64 users should type LOAD "MENU 64",8 and press the return key. When you get the Ready prompt, the menu is loaded and you should type RUN to see a list of the programs on your disk. C-128 users need only press the shift and run-stop keys. When all the programs are displayed on the screen, you can run the one you select by pressing a single key.

Loading from Keyboard

If you do not wish to use the menu program, follow these instructions.

C-64: To load a C-64 program written in Basic, type: LOAD "DISK FILENAME",8 and then press the return key. The drive will whir while the screen prints LOADING and then READY, with a flashing cursor beneath. Type RUN and press the return key. The program will then start running. To load a C-64 program written in machine language (ML), type: LOAD "DISK FILENAME",8,1

C-128: All C-64 programs can be run on the C-128 as long as your computer is in C-64 mode. All C-128 programs are clearly labeled on the directory page. Your C-128 *must* be in C-128 mode to run these programs. To load a C-128 mode program, press the F2 key, type the disk filename and then press the return key. When the program has loaded, type RUN.

Making Copies of ReRUN Files

Many programs on your ReRUN disk have routines that require a separate disk onto which the program writes or saves subfiles. To use these programs, you must first make a copy of the original program onto another disk that has enough free space on it to hold these newly written subfiles.

It's simple to make a copy of a Basic program. Just load it into your computer as outlined above, and then save the program back onto a separate disk that has plenty of free space for extra files.

Copying an ML program is not so simple. You cannot simply load and save an ML program; you'll need to use a disk-backup utility program, such as the one on your Commodore Test Demo disk.

Directory

Page	Documentation	Disk Filename	File Type
		*MENU 128	BASIC
		MENU 64	BASIC
1	**RUN Paint**	RUNPAINT BOOT	BASIC
		OB.BOOT RP	ML
		SYS.STUFF.H	ML
		OB.RP	ML
		RPM.STILL.LIFE	ML
		RPM.PHOTON.EYE	ML
		BASIC BOOT.HEX	BASIC
		OB.BOOT.HEX	BASIC
		OB.RP.HEX	BASIC
		SYS.STUFF.HEX	BASIC
13	**Kalah**	KALAH	BASIC
16	**The MS-DOS Connection**	*MSDOS CONNECTION	BASIC
		*MDOS.ML	ML
		*CREATE MS-DOS ML	BASIC
20	**Roll Them Bones**	YATZEE	BASIC
22	**The Multitasking Factor**	MULTITASK FACTOR	BASIC
27	**Amazing!**	*AMAZING SOURCE	BASIC
		*AMAZING	ML
27	**Crabbie**	£*CRABBIE	BASIC
		£*ML-CRAB	ML
		£*HSCRAB SEQ	ML
28	**Kidnapped!**	£KIDNAPPED	BASIC

* — C-128 mode only
£ — Bonus program

Before you run a program, carefully read the documentation that pertains to it.

RUN it right: **C-64 or C-128 (in 40-Column mode); joystick or 1351 mouse**

RUN Paint

By Robert Rockefeller

RUN PAINT IS A SOPHISTICATED, joystick-based paint program that lets C-64 and C-128 users create and print out bit-mapped graphics. It runs in 40-Column mode and uses both hi-res and multicolor screens. An easy-to-use system of nested, pop-down menus makes it unnecessary to study and memorize sets of complicated commands or to continually refer to the documentation.

GETTING STARTED

Before starting to use RUN Paint, make sure you have a joystick or 1351 mouse plugged into port 2 (do not plug them in with the power on). Then turn on the computer. RUN Paint defaults to a joystick in port 2, so if you're using a 1351 mouse instead, press the F3 key at this point. Pressing F1 will reselect the joystick.

To start RUN Paint in either 64 or 128 mode, just load the program called RUNPAINT and run it. After half a minute or so, the screen clears and a flashing arrow appears in the center. The arrow is a pointer that you move around with the joystick or mouse to make menu selections and to draw on the screen.

The rest of this article will take you step by step through each of RUN Paint's functions. By the time you've finished, you'll have a good working knowledge of the power and sophistication of this program. After that, you can use the documentation as a reference guide.

THE MENU SYSTEM

You can't draw anything until you select an option from a menu. To activate the menu system, move the pointer at least five pixels above the top of the screen border and press the firebutton. When the main menu appears, select one of the options thereon by moving the pointer onto it and pressing the firebutton. This operation is known as "clicking." Take care not to move the pointer off the menu until you're finished with it, because the menu will then disappear.

Clicking an option displays a submenu from which you can make further selections. Some of the submenu options perform an action, and some make yet another submenu pop down. Accessing some of RUN Paint's features requires descending through three levels of submenus.

Many of the program's menus include an option that's indented two spaces, possibly with an asterisk beside it. These are options you can click on and off. The asterisk means the option is turned on.

The Main Menu

The main menu contains six options and four arrows. The latter are "scroll arrows" that you use to move the screen within the page buffer (see below). To observe these arrows in action, draw something on the screen. Here's how:

Activate the menu system by clicking on the Draw option in the main menu; then, when a submenu appears, click the Freehand option. You should note that making a selection may cause the menu to disappear.

Now, position the pointer on the arrow pointing right and press the firebutton. This will make the contents of the screen seem to scroll left, because the screen is being moved to the right through the page buffer. Releasing the firebutton stops the scrolling and makes the main menu re-appear. There are arrows corresponding to the other three directions also, but the up and down arrows are nonfunctional on the C-64 because of insufficient memory.

Following is an explanation of the functions accessed through each of the six main menu options.

The Pen Submenu

The two main drawing tools in RUN Paint are the pen and the brush, and the various options associated with them are controlled through the Pen submenu. There are six different pen styles, and an unlimited number of brush shapes and patterns are possible, since RUN Paint allows saving and loading of brushes and patterns. Brushes work by painting the part of the screen covered by the brush with the current pattern whenever the firebutton is pressed. Here's an example:

Activate the menu system, click on Pen, then move the pointer down to Use Brush and click on a brush for drawing. Next, move the cursor back onto the main menu and click on Draw, followed by Freehand. When you move the brush around while pressing the

firebutton, the current brush pattern appears wherever the brush goes. RUN Paint lets you select from 11 different brushes and 35 different patterns at any one time.

Following are descriptions of the options in the Pen submenu:

Select Color lets you choose the color you want to draw with. When you click on a color, the border color changes to your choice to indicate the current drawing color.

Use Pen and **Use Brush**, which specify the pen or the brush for drawing, are mutually exclusive; if you select one, you deselect the other. An asterisk is always present beside the currently selected tool. The drawing modes in which you can select either pen or brush are Freehand, Lines, Rays, Spray, Ellipse and Box. Flood always uses the pen, regardless of which tool you've selected.

Affect Color. This option is either on or off. When it's off, none of RUN Paint's graphics commands affect color memory. If you want to use a Monochrome mode, just turn off Affect Color after activating the program.

Reflect On simultaneously creates up to three mirror images of an object as you're drawing it. Here's an example:

Enable the menu system, click on Pen, then on Set Reflect and on X in the Set Reflect submenu. Next, return to the Pen submenu and activate Reflect On. Now move back to the main menu and click on Draw, then on Freehand. As you move the pointer around while pressing the firebutton, you can verify that a mirror image is drawn, reflected in the x-axis. Try the other options in the Set Reflect submenu, namely Y and XY. (See Set Reflect and Move Mirror, below.)

Set Reflect displays a submenu of reflection modes you can choose from when Reflect On is enabled. X produces reflection on the x-axis, Y on the y-axis and XY in the opposing quadrant. (Also see Reflect On, above, and Move Mirror, below.)

Move Mirror is the option you use to position the reflective x and y axes anywhere you want on the screen.

Select Pen lets you choose one of six pens for drawing when the Use Pen option is on. The first option draws normal solid lines and the second draws double-width solid lines. The third to sixth options produce one of four styles of dotted lines. In Freehand mode, only solid lines can be used. The dotted lines work only in the Lines and Rays modes.

Select Brush lets you choose a brush shape to use when Use Brush is on. Just click on a brush.

Select Pattern lets you choose a pattern when Use Brush is on. Just click on any pattern.

THE DRAW SUBMENU

The Draw submenu is used more frequently than any of the others, since it contains most of the commands for placing graphics on the screen.

Alter Color changes colors on the screen. You'd use it, for example, if you drew a flower with white petals and then decided it would look better in red. Selecting Alter Color brings up a submenu containing two options: **Card** and **Screen**. Card restricts the color change to a single card (see Technical Notes, below), which you select with the pointer. Screen makes the color change affect the entire screen. After selecting one of these options, a third submenu pops down from which to select the new color. In our example, you'd select red.

Once you select a color, the menus disappear, the border color changes to the color you selected, and you're ready to initiate the color change. Position the tip of the pointer over the color you want to alter and press the firebutton. The border color changes to match the color of the pixel under the pointer. If this is indeed the color you wish to change, press the firebutton and the change takes place.

If nothing happens, you probably have the pointer positioned on a blank pixel. Move the pointer a little bit and try again. If the pointer is placed on the wrong color, you can abort the change by executing an Undo (see below) or by activating the menus, then moving the pointer off the menus back onto the screen to try again.

Wash lets you change the background color on a card-by-card basis in Hi-Res mode. When you select Wash, a menu pops down from which to choose the new color. After you select a color and the menus disappear, move the pointer onto a card and press the firebutton to change the backgound color of that card.

Flood fills an enclosed area with a solid color. Here also, a menu pops down from which to select the color you want, and the menus disappear after you choose. Then position the pointer over the area you want to fill and press the firebutton. You can abort a fill in progress by executing an Undo (see The Undo Feature, below).

Freehand makes a freehand drawing. Pressing the firebutton while moving the pointer around draws a line. (See the Pen submenu, above.)

Lines is the option used for drawing straight lines. Position the

pointer where you want a line to start and press the firebutton; then move the pointer to the line-end position and press and hold down the firebutton until the line is completely drawn. (See the Pen submenu, above.)

Rays draws lines that radiate from a common origin. Move the pointer to the desired starting point and press the firebutton; then move the pointer to a line-end position and press the fire-button again to draw the line. Draw additional lines by moving the pointer to new end positions and pressing the firebutton again. As in the Lines option, you must hold the firebutton down until the line is complete. (See the Pen submenu, above.)

Spray produces a spray effect. When you select this option, a submenu pops down with three additional choices—Light, Medium and Heavy—which specify the intensity of the spray effect.

Spray uses either the pen or the brush and works on a timer. In Heavy mode, it plots a point or paints a brush shape every $^{2}/_{60}$ of a second. The corresponding times for Medium and Light modes are $^{5}/_{60}$ and $^{15}/_{60}$ seconds, respectively.

If Use Brush is on, you can get an airbrush effect by selecting a brush consisting of a grid of dots. (See Select Brush, above.)

Eraser mode erases the screen card by card.

Edit lets you modify either a section of the screen, the brushes, the patterns or the current character font. Selecting Edit displays a submenu. To modify a section of the screen, click on Pixel Edit. After your selection, the menus vanish and the pointer appears, surrounded by a flashing box. Position the box over the part of the screen you want to edit and press the firebutton. This enlarges the screen inside the box, copies it to the bottom of the display, and then brings a color menu to the center of the display, from which you select a new drawing color. The top of the display shows an unmagnified section of the screen, so you can see the effect of your edits.

You edit pixels by positioning the pointer over them and pressing the firebutton. To erase a pixel, set the drawing color to the screen color. You can select a new area to edit by moving the pointer to the top of the screen and pressing the firebutton.

The Font, Brush and Pattern editing modes operate in a similar manner. After selecting one of them, the screen clears and the font, brushes or patterns are copied to the top of the screen. Select a character, brush or pattern for editing by clicking on it. The center of the screen shows a color bar containing two colors: blue and black. Select blue to erase pixels and black to set pixels. You select

a different character, brush or pattern to edit by moving the pointer into the top area of the screen and pressing the firebutton.

Ellipse uses either the pen or the brush to draw ellipses. Click twice to set two opposing corners of a box, and an ellipse will be drawn within the box. (See Solid, below.)

Box uses either the pen or the brush to draw boxes. Click twice to set two diametrically opposite corners, and a rectangle appears. (See Solid, below.)

Solid determines how Ellipse and Box work. When this option is on, ellipses and boxes are drawn filled-in. When it's off, they appear as outlines.

The Shape Submenu

The Shape submenu contains commands for cutting and pasting or erasing rectangular areas of the screen, along with whatever is within those areas. It uses a special area of memory called the "shape buffer," where shapes you cut or copy from the screen are stored. In Paste mode, the shape in the buffer is pasted on the screen. Note that it's impossible to paste a hi-res shape on a med-res (multicolor) screen, or vice-versa.

Cut duplicates a rectangular area and its contents from the screen to the shape buffer and erases it from the screen. Move the pointer to one corner of the shape and click, then to the opposite corner and click again.

Copy copies a shape on the screen into the shape buffer, but the shape remains on the screen. Execute this exactly as you would Cut.

Paste places a shape that's in the shape buffer onto the screen. In this mode, the pointer is surrounded by a box of the same size as the shape in the buffer. Move the box to where you want it located and click once.

Erase eliminates the contents of a rectangular portion of the screen. Move the pointer to one corner of the rectangle and click, then move it to define the opposite corner and click again.

Flip X. When this option is on, the shape is pasted and flipped horizontally about the y-axis.

Flip Y pastes the shape and flips it vertically about the x-axis.

RVS pastes the shape in reverse field. This option works well in Hi-Res, but not so well in Med-Res (Multicolor) mode.

Cover mode makes the shape completely cover the screen area where it's pasted. Normally, any areas of the shape that are blank are not pasted.

THE TYPE SUBMENU

The Type submenu is used to place text on the screen. Type is essentially monochrome and uses the current color.

Font. Clicking this option selects a new character font and enables Type mode. After you click, a submenu will appear offering an additional three options. The first corresponds to the RAM font, which RUN Paint can load in via the Load submenu (see Disk, below). If this option is blank, a font hasn't been loaded yet. RUN Paint can use either standard Commodore 8-bit character sets or special RUN Paint fonts, which are 16 bits wide and 16 high.

Graphics, the second Type option, selects the built-in ROM character set that consists of the uppercase alphabet and special graphics characters.

Text, the third option, selects the ROM character set containing the upper- and lowercase alphabets and business graphics characters.

After clicking on an option, you can begin typing. A flashing box shows where the next character will appear, and, when you press the firebutton, you can move this box anywhere you wish on the screen. Press the firebutton again after the box is positioned. The following are special features available while typing:

Cursor keys: Move the flashing box around.

Control/RVS On: A standard Commodore character set has 256 characters, numbered 0–255, but RUN Paint can use only 128 characters at a time. Simultaneously pressing the control and 9 keys selects characters 128–255 for typing.

Normally, characters 128–255 are just reversed images of characters 0–127, and Commodore uses them to provide a flashing cursor. RUN Paint doesn't need these reversed characters, so they can be replaced by another font, such as italics. This lets two 8-bit character sets reside in memory at once. RUN Paint provides no way to replace the reversed characters.

Control/RVS Off: Simultaneously pressing the control and 0 keys selects characters 0–127 for typing.

Home: Moves the typing box to the home position.

Return: Moves the typing box to the start of the next line.

DEL: Pressing the insert-delete key deletes the character to the left of the cursor.

Now, getting back to the Type submenu:

Width displays a submenu with three options: Normal, Double and Quadruple. Click on the character width you want.

Height also produces a choice of Normal, Double and Quadruple. Click on the height you want.

The next five options, affecting how text is placed on the screen, are mutually exclusive; only one can be activated at a time.

Cover, which is the Default mode, makes characters you place on the screen completely cover the area inside the typing box. In this mode, it's impossible for you to make a character blend in with the background.

RVS is similar to Cover, except that characters are reversed before being placed on the screen.

Or places characters on the screen using the logical Or operation, thus letting them blend in with the background.

And. When this option is selected, characters are placed on the screen using the logical And operation. To see how this works, paint the entire top of the screen with a pattern using a large brush, then select the Quadruple option and the And option on the Type submenu. Now choose one of the fonts, position the typing box on the pattern and begin typing.

XOr lets you place selected characters on the screen using the logical Exclusive-Or operation. This means the characters can blend in with the background.

THE DISK SUBMENU

The Disk submenu is used to save and load files to disk, as well as to issue disk commands and select the disk device number. RUN Paint filenames must not contain any spaces.

Load. This option on the Disk submenu can load a number of types of files, which are selected from a submenu. After you select a file type, RUN Paint displays a list of the files of that type available on the disk. Just move the pointer onto the filename you want and press the firebutton.

RUN Paint can load standard Commodore character sets, as well as files created with other programs, such as Koala Painter, Doodle! and Flexidraw. These files must be renamed to conform with RUN Paint format. (See Load Font, Monochrome, Hi-Res Screen and Med-Res Screen, below.)

Use the **Font** option in the Load submenu to load a font. As mentioned above, RUN Paint can use standard Commodore character sets. However, the file must be renamed according to RUN Paint format before the program can load them. All RUN Paint font filenames must begin with the letters RPF and a period. For example,

a character set named ITALICS would have to be renamed RPF.ITALICS. Remember, no spaces are allowed in a filename.

The **Page** option loads an entire page, **Shape** loads a shape, **Patterns** loads a set of patterns, and **Brushes** loads a set of brushes.

Monochrome provides a way to load a straight 8K monochrome bit map with no color. Flexidraw saves pictures in this format. Before you can load a Flexidraw picture into RUN Paint, you must rename it. For example, a Flexidraw file named JAGUAR would have to be renamed RPO.JAGUAR. Once again, there can't be any spaces in the filename.

After loading a monochrome bitmap, RUN Paint enters a special mode where you can copy a section of the screen to the shape buffer. If you go to a menu, the screen is copied to the page buffer. If you perform an Undo, the screen will go back to what it was before loading.

Hi-Res Screen loads high-resolution screens that include color, such as Doodle! picture files. As with Flexidraw files, Doodle! files must be renamed to RUN Paint format before they can be loaded. A Doodle! file named DD.FIELD would be renamed RPH.FIELD.

Also as with Flexidraw files, after loading, RUN Paint enters a special mode enabling you to copy a section of the screen to the shape buffer. If you go to a menu, the screen is copied to the page buffer, and performing an Undo restores the screen as it was before loading.

Med-Res Screen loads medium-resolution (multicolor) screens, such as Koala picture files. Like the other file types I've mentioned, Koala files must be renamed according to RUN Paint format before they can be loaded. A Koala file named APIC A FIELD would be renamed RPM.FIELD.

As with the previous two commands, RUN Paint enters a special mode where you can copy a section of the screen to the shape buffer. Going to a menu copies the screen to the page buffer, and an Undo restores the screen as it was before loading.

The **Utility** option enables RUN Paint to load in and execute user-defined, machine language utility programs that can give RUN Paint more capabilities. The programs must be assembled to run at address $6C00, and their filenames must begin with the letters RPU and a period.

Save. This option on the Disk submenu displays a further submenu from which various types of files can be saved. After selecting a file type, enter the desired filename, omitting a prefix, since RUN Paint

will install it automatically. For example, if you enter ITALICS as the name of a font, RUN Paint will save it as RPF.ITALICS. As before, don't include any spaces in the filename.

There are eight commands for saving files, representing eight different file types. **Font, Page, Shape, Patterns** and **Brushes** are self-explanatory. **Monochrome** saves the contents of the screen as a straight 8K monochrome bit map with no color. **Hi-Res Screen** saves the contents of the screen as a Doodle!-compatible file. **Med-Res Screen** saves the screen as a Koala-compatible file. After you enter the filename for a med-res screen, the text screen will fill with strange colors. Don't worry. This is just because the text screen and the med-res screen share the same color memory.

Other Disk submenu options are:

Command. Select this option from the Disk submenu to issue a command to the disk drive for formatting a disk or scratching or renaming a file.

Set Device lets you specify device 8 or 9 for saving and loading.

THE MODE SUBMENU

The Mode submenu is a catch-all for commands that don't fit in anywhere else. It lets you set the screen and pointer color, print, select high or medium resolution, and more.

Cursor. This Mode submenu option displays a further submenu that offers three options: Solid, Flash and Card Restricted. **Flash**, the default, produces a flashing cursor. With **Solid**, you get a non-blinking cursor. You must also select the cursor color from a submenu. **Card Restricted** restricts cursor movement to coordinates that coincide with the upper-left corner of a card. This is often useful in Type mode and when pasting shapes.

Screen Color displays a submenu from which to alter the screen color. The color is actually changed for the entire page, not just the screen, and on the C-128 this takes a second or two. The change isn't finalized until the cursor is moved off the Screen Color submenu.

GoTo. This Mode submenu option lets you move around the page buffer quickly. On the C-64, three options are available in this submenu: Left, Middle and Right. On the C-128, you have an additional four options: Top, Bottom, Screen Up and Screen Down. As mentioned above, the page buffer is wider than the screen. In fact, it's 80 cards wide. Clicking on **Left** brings columns 0–39 of the page buffer to the screen. **Middle** and **Right** display columns 20–59 and 40–79, respectively. Clicking on **Top** moves the screen to

the very top of the page buffer on the C-128. **Bottom** moves the screen to the bottom of the page buffer. **Screen Up** and **Screen Down** move up and down through the page buffer approximately half a screen at a time.

Clear Screen. This option in the Mode submenu predictably clears the screen. This action can be reversed with an Undo command.

Clear Page clears the entire page and cannot be undone.

Print. Various printout options are accessed through this submenu. They let you print part or all of a screen or page.

Screen prints just what is currently displayed. If the Define option (see below) is on, you can specify the number of screen lines to print. If Define is off, the full screen is printed.

Page prints the page buffer. Similar to printing a screen, if the Define option is on, you can specify the number of lines to print from the page. If Define is off, the full page is printed.

Rectangle defines a rectangular area of the screen to be printed. This area can be as large or as small as necessary. After the menus disappear, click once to define one corner of the rectangle, then move the pointer to define the diametrically opposite corner and click again to start printing. Rectangle doesn't work with the Prowriter printer.

RVS. If this is set to on, the printout will be in reverse field.

Disk. When Disk is on, the printer output will be sent to the disk. You must enter a disk filename before printing begins.

Define works with Screen and Page, but not Rectangle. As mentioned above, this option lets you define the number of lines to print from the screen. After you choose to print a screen, the menus disappear and a horizontal line appears. Move the line to define the bottom of the part of the screen you want printed and press the firebutton. The screen will be printed from the top down to the line.

You can also define the bottom line when you print a page, but printing takes place from the top of the page buffer down to the line. You can use Screen Up and Screen Down to position the screen in any part of the page buffer on the C-128.

Click on **Select Printer** to tell RUN Paint what type of printer you have. The program supports three printers and their compatibles: the Commodore 1515, the Epson and the C.Itoh Prowriter. If you have one of the printer interfaces that offer 1515 emulation, you should be able to use the 1515 printer driver, regardless of the type of printer you own.

Click twice on **Quit** to leave RUN Paint and return to Basic. On

the second click, press the button for at least a second.

Use the **Device** option to tell RUN Paint whether you're using a joystick or a mouse.

Hi-Res and **Med-Res** specify either High Resolution or Medium Resolution mode. These options are mutually exclusive; selecting one unselects the other.

The Undo Feature

I'll wrap things up with a look at RUN Paint's most useful feature: Undo. Undo is not selected through the menu system, so I'll illustrate it with an example. Draw something on the screen, then activate Undo by moving the pointer five pixels below the bottom border of the screen (as far down as it will go) and pressing the firebutton. The screen will clear, "undoing" the last function performed.

Each time you access the menus, the screen's contents are copied to the page buffer, and Undo works by copying the page buffer back to the screen. This means you can reverse any action performed since the last time the menus were accessed.

Technical Notes

The VIC chip in the C-64 and C-128 organizes the graphics screen into little rectangles called "cards." The screen contains 25 rows of cards, with 40 cards per row. In Hi-Res mode, each card contains eight pixels horizontally and eight pixels vertically, and only two colors are possible per card: a foreground color and a background, or screen, color. If you try to add a third color to a card, the foreground color will change to the new color.

In Med-Res mode, also called Multicolor mode, three different foreground colors are possible per card, and the background color is the same for all cards. The luxury of having three foreground colors is paid for by decreased screen resolution. The pixels are twice as wide as in Hi-Res mode, and a card contains only four pixels horizontally by eight vertically.

The Page Buffer

RUN Paint uses the screen as a window atop a larger area, referred to as the "page buffer." On the C-64, RUN Paint can handle drawings up to 640 pixels wide and 200 pixels high. With its larger memory, the C-128 can handle a full $8\frac{1}{2} \times 11$-inch page, allowing drawings of up to 640×792 pixels.

RUN it right: **C-64 or C-128 (in 40-Column mode)**

Kalah

By Michael Broussard

KALAH, WRITTEN COMPLETELY IN BASIC for the C-64 or 128 (in 40-Column mode), is a game of strategy based on a popular African pastime that involves moving counters, usually pebbles, among 14 pits dug in the ground. To play the game, first load Kalah from the ReRUN disk according to the instructions in How to Load, and then run it. The computer is your opponent.

When you type RUN, Kalah clears the screen and asks you to declare the skill level you want: Beginner, Intermediate or Expert. To make your choice, type 1, 2 or 3, respectively, and press the return key. Try level 1, Beginner, for your first game. Later, I'll touch on how Kalah varies its strategy according to the skill level chosen.

Next, Kalah prompts you to enter the number of counters (called "stones") that you want in each pit to begin with. Pressing the return key chooses the default number, which is 3. (You may actually specify any number from 1 to 6, but more about this later.) After you make your choice, the screen clears again and shows the game "board," which consists of 14 squares, representing the pits of the original game. (See Figure 1.)

Each pit displays a value that indicates the number of stones it currently contains. If no value is shown, that pit is "empty." The six pits in a row at the bottom of the board—labeled A through F—are under your control. The six above—labeled G through L—are controlled by the computer. The pit at the right end of the two rows is your "home pit;" the one at the far left is the computer's. The object of the game is to accumulate more stones in your home pit than the computer does in its.

How To Play

The computer randomly decides who will play first. In the physical game, you would play by removing all the stones from one of your pits and redistributing them, one at a time, to adjacent pits in a

counter-clockwise fashion, skipping no pits *except* the home pit of your opponent. In the computer game, the principle is the same, but the machine does the moving for you.

To choose a pit to play from when it is your turn, simply type the letter (A through F) of the one you want and press return. (Use the delete key if you change your mind or make a mistake.) When you make your selection and press return, the numbers in the squares on the screen change to reflect the new situation. The computer's play is similar, except it chooses from pits G through L and skips *your* home pit.

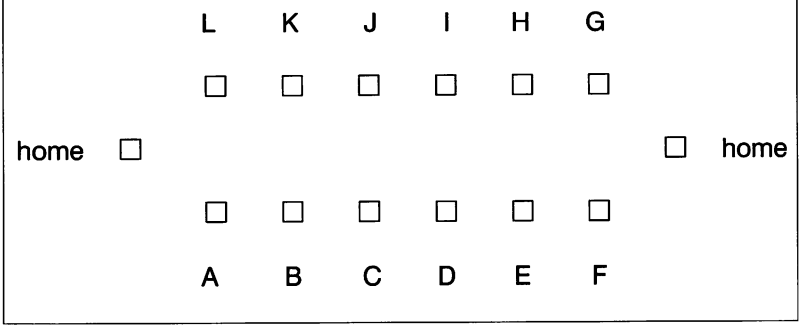
For example, if your move selection is A, the three stones are removed from that pit and deposited in pits B, C and D. When you've completed the move, pit A is empty and pits B, C and D each contain 4 stones. This ends your turn. If your first move is from pit E, the three stones end up in pit F, your home pit and the computer's pit G. As another example, if a play is from pit E, and it already contains ten stones, the ten would be "sown" into pits F, your home pit, pits G through L, and pits A and B.

Note, again, that you sow a stone into your home pit when you pass it, but you skip the opponent's home pit. Moreover, stones may not be played *from* a home pit. Once a stone is "home," it stays there for the rest of the game.

Two further rules underlie much of the strategy involved in the game. One is that if you make a play that ends with the last stone deposited into your home pit, you immediately get another turn. Through careful playing, you might get several turns in a row.

The other rule is that if the last stone you play ends up in an

Figure 1. How the Kalah game "board" appears on the screen.



empty pit that belongs to you, any stones in the computer's pit that's directly opposite are "captured" and placed immediately in your home pit, thus swelling your score. For example, suppose your pit C is empty and pit A contains two stones. If you play from pit A, the first stone ends up in pit B and the last one in C, which was empty. You then capture any stones that may be in the computer's pit J, which is directly opposite C. You place the stones from pit J (if any) in your home pit, and your turn ends.

Play continues until one player has no more stones in any of the six pits on his side of the board. The game is then over, and any stones remaining on the opponent's side are moved to his home pit and count toward his score. (For this reason, it's not always wise to "go out" too early!) Whoever then has the most stones in his home pit is the winner of the game.

FURTHER WRINKLES

As the computer ponders its next move, it displays "Thinking. . ." on the screen, so that you know it is doing something. As a play is made by either player, the values in the affected pits turn red momentarily so that you can better see the effect of the move.

The computer pauses briefly before continuing or prompting for your next move. If you prefer not to wait, you can end the pause by pressing the space bar. Alternatively, you can adjust the length of the pause by changing the value assigned to the variable T1 on line 100 of the program. Decreasing that value shortens the pause between moves, and vice versa.

A word about the skill levels from which you choose at the beginning of the game: At the Beginner level, the computer takes any free moves it can find and then moves at random. At Intermediate level, the game also adds capture and capture-avoidance features to its strategy. And in Expert mode, the computer tries to determine which play leaves it in the best position with respect both to extra plays and to captures on its next move.

Your choice, also at the start of the game, of the number of stones per pit will somewhat determine the quality of the game. The default is 3, but you may select any number from 1 to 6. Choosing a greater number increases the length and complexity of the game.

The rules of Kalah are easy to learn, but you soon find that the more you play, the more strategy you discover. Try it and find out for yourself why this game's popularity has endured for hundreds of years.

RUN it right: **C-128 (in 40- or 80-Column mode); 1571 or 1581 disk drive**

The MS-DOS Connection

By Miklos Garamszeghy

MS-DOS CONNECTION IS AN EASY-TO-USE Basic 7.0 program that enables the C-128 to read or write text and data files from or to almost any type of MS-DOS disk—5¼- or 3½-inch, single- or double-sided, and with eight, nine or ten sectors per track. The only disks that won't work are those with a high density, 1.2- or 1.44-megabyte format. *(The author is working on a C-64 version of this program, which we hope to publish in the near future.—Eds.)*

The program can transfer files up to 45K long, which is adequate for most needs. It handles Commodore sequential (SEQ), program (PRG) and user (USR) files either in Binary mode, where the files aren't manipulated, or in ASCII-PETSCII Translation mode, where they are converted between standard ASCII and Commodore ASCII (also known as PETSCII). Most text- and data-file transfers will use the sequential file type.

In addition to transferring files between MS-DOS and Commodore DOS, this utility can also transfer them between 1571- and 1581-formatted disks and from one size MS-DOS disk to another (such as 5¼-inch to 3½-inch). Because the 1541 disk drive doesn't support the MFM formatting scheme used by MS-DOS, a 1541 can be used only for Commodore-to-Commodore transfers.

Note that, while MS-DOS Connection transfers text and data files between MS-DOS machines and the C-128, it does not give your C-128 any form of compatibility with machine language program files and batch files written to run on an MS-DOS computer. These, usually identified by a file type of .EXE, .COM or .BAT, *won't work on the C-128 in any mode*. However, if, for example, you download a C-128 program to an MS-DOS disk and then convert the file to C-128 format in Binary mode, the program will work on the C-128 as originally intended. This capability can be a real boon if, say, you have a faster modem on your MS-DOS machine than on your 128.

When you run MS-DOS Connection, the terms "source" and

"target" that you'll see on the screen designate the files being transferred from and to, respectively, and "MS-DOS" refers to any IBM-PC or compatible operating system (that is, any version of PC-DOS or MS-DOS). "Commodore DOS" and "CBM DOS" refer to the normal operating mode of Commodore disk drives (in which PRG and SEQ files are created on the 1541, 1571 and 1581, for example).

To transfer a file from one type of disk to another, follow the procedures described below. Screen prompts will show the way.

THE SOURCE

When you run the MS-DOS Connection main program, the machine language portion (MDOS.ML) is first loaded from drive 8, if it's not already in memory. Then the opening screen appears, at which time you can remove the disk from drive 8 if you wish.

The opening screen requests information about your source disk and drive. At the prompt for type of source disk, enter 1 for an MS-DOS disk or 2 for a Commodore disk. You can also enter 3 to quit the program. Press the return key after making your selection and then select the source disk drive. You can specify any serial-bus device number from 8 to 12. If you specify a number outside this range, the source disk type prompt will reappear.

At this point, insert the source disk into the source drive and press return to proceed, or, if you decide to use a different source, press the escape key to go back to the opening menu so you can make other choices.

After you've pressed the return key, the program reads the disk's directory, and, in the case of an MS-DOS disk, automatically determines the disk type (number of sides, number of sectors per track, etc.) and decodes the MS-DOS file allocation table (FAT), which is similar in function to the Commodore disk bit allocation map (BAM). As this happens, a status display informs you of progress. This entire procedure should take less than a minute, the actual time depending on the number of files in the main, or root, directory of the disk. (It may take a bit longer to read the directory of a 3½-inch MS-DOS disk, because the 1581 won't immediately recognize that it holds a non-Commodore disk.)

The directory display basically lists files in alphabetical order. All 1581 directory partitions (CBM files) or MS-DOS subdirectories appear first, with the subdirectories identified by a <dir> under the file-size field. MS-DOS files are sorted by filename, and Commodore files by type—CBM, PRG, REL, SEQ, USR—and, within these, by

filename. The sorting is done by machine language, so it's quite fast, even for long directories.

The directory appears in a 15-entry window and can be scrolled in both directions. If you scroll far down the list and wish to get back to the start, just press the home key.

The disk name and ID code (Commodore) or volume label (MS-DOS), along with the number of files in the directory and the total number of bytes these files occupy, are listed at the top of the directory screen. Note that file lengths are given in bytes, not the blocks usual for Commodore disks. As a result, the listed lengths of Commodore files are only approximate (block count times 254); MS-DOS file sizes, on the other hand, are exact, since they come straight from the directory entries.

To select a file to read or a subdirectory to access, use the cursor-up and cursor-down keys to move the highlighting bar to the desired file, then press return.

If you have your C-128 in 80-Column mode, the right side of your directory screen will contain a summary of these instructions.

Don't remove your source disk from the source drive until you see a prompt to insert another disk. If you change disks (especially MS-DOS disks) when the program doesn't know about it, it may transfer the file incorrectly and even corrupt other files on your target disk. You won't be prompted to insert a disk before reading a file from the on-screen directory, because the program will assume you haven't removed the disk that contains the file.

If you're transferring from a Commodore disk, you must, after selecting the file, also select the type of Transfer mode: Binary or PETSCII-ASCII Translation. Binary mode transfers the file exactly as is, while Translation mode converts it from PETSCII to ASCII as it's being read into memory. (All files in memory are assumed to be in ASCII format.)

While MS-DOS Connection will read PRG, SEQ and normal USR files, it will not read REL (relative) or GEOS-type USR files, even though it lists them in a Commodore disk directory.

The Target

Now it's time to write the target file. At the prompt for target file type, select 1 for MS-DOS, 2 for Commodore DOS or 3 to return to the directory display without writing the target file. After designating a file type, select the target drive, which can be the same as, or different from, the source drive.

Next, enter a filename for the target file. In MS-DOS, the proper format is FILENAME or FILENAME.TYP, where the main name is 1–8 characters long and the optional extension is 1–3 characters. In Commodore DOS, the filename can have from 1–16 characters. In writing to a Commodore file, you must also select the transfer mode (Binary or PETSCII-ASCII) and the file type (SEQ, PRG or USR).

With all the target information entered, insert the target disk and press return to write the file. You'll return to the directory display automatically when it's done.

Several steps are involved in writing MS-DOS target files. The target disk directory is read and its FAT decoded, the file is written and then the directory and FAT are updated. With a Commodore disk, all this takes place automatically during the write operation.

SUBDIRECTORIES

MS-DOS Connection lets you transfer files from any MS-DOS subdirectory or 1581 partition. When you select an MS-DOS entry marked <dir> or a Commodore CBM file (on the 1581 only) and press return, the new directory is read and displayed on the screen, replacing the previous one. You can return to the previous directory in MS-DOS by selecting the first entry, <parent> <dir>, in the new directory. With the 1581, you can't go backward through a directory chain, but must return to the root directory, and then follow the chain forward again.

If you're several directories into a tree (either MS-DOS or 1581) and want to get back to the first level or see the directory of a new disk of the same type (MS-DOS or Commodore DOS), press the R key. This will immediately reread the root directory of the disk.

When reading an MS-DOS directory, the program ignores the file attributes (byte 11), except those for the volume label and subdirectories, which do not represent valid files. Thus, you can access and display hidden and system files that won't appear in response to a normal MS-DOS directory (DIR) command.

All files that the program writes to MS-DOS and 1581 disks are listed only in the root directory, not in subdirectories.

OTHER TYPES OF TRANSFERS

As I mentioned earlier, MS-DOS Connection is useful for purposes other than transferring files between MS-DOS and Commodore machines. It can copy normal Commodore SEQ, PRG and USR files between a 1581 and 1571, and even most C-128-compatible hard

drives. I also find it a convenient way to transfer MS-DOS files between 5¼- and 3½-inch disks for use on my various MS-DOS computers.

In addition to straight copying, the program can also convert text files between true ASCII and PETSCII, using any Commodore-compatible drive. For ASCII to PETSCII, read the file in Binary mode, then write it in Translation mode. For PETSCII to ASCII, read the file in the Translation mode, then write it in Binary mode. This kind of conversion is helpful for swapping files between incompatible word processors or for using text files that have been downloaded from bulletin board systems. (Most public-access BBSs store text in ASCII mode, while many Commodore word processors expect PETSCII.)

In addition to translating the normal upper- and lowercase text characters, conversion from PETSCII to ASCII automatically adds a linefeed (CHR$(10)) after every carriage return character (CHR$(13)), while conversion from ASCII to PETSCII removes all linefeeds. ASCII codes with the high bit set, as produced by some MS-DOS word processing programs, such as WordStar, are treated for text conversions just like their normal ASCII counterparts, without the high bit set.

RUN it right: **C-64; joystick**

Roll Them Bones

By Robert Cook

YATZY IS AN EASY-TO-LEARN C-64 version of the popular dice game where you try to roll five dice to get as high a score as you can. It's designed for one to four players, adults or children who can do simple addition.

To begin each turn, the C-64 rolls the dice and displays them on the right side of the screen. Then you have two chances to improve your score by rolling any combination of the dice again. Using the joystick in port 2, move the pointing hand to select the dice you wish to reroll and press the firebutton; each die will disappear in turn.

When you've chosen all the dice you want to reroll, move the hand down to the Roll box and press the firebutton again. The dice you've chosen will be rerolled. If, before rolling, you decide you want to rechoose any dice, just move the hand up to the Undo box and press the firebutton. Note that the number in the Roll box is always the number of your current roll.

After your third roll, the pointing hand moves automatically to the scoring area on the left side of the screen. You can also proceed with scoring after your first or second roll—if you're satisfied with the total or the configuration—by moving the hand to the Roll box and pressing the firebutton.

SCORING

In the scoring area, there are two sections, the upper listing the possibilities for each die (1 through 6), and the lower showing various poker-hand bonus combinations. You score after each turn by moving the hand to the so-far-unused category that will give you the highest score with what's currently showing on the dice. Then press the firebutton to enter your score and display it in your score column.

Note that you *cannot* use a category more than once in a game, and, if your current dice don't fit in the category you've chosen, you get a zero for that category. The game ends when you (and each of the other players) have chosen each of the thirteen categories.

The categories in the upper part of the scoring area are for specific numbers, 1 (ace) through 6. Your score for each turn is the category number multiplied by the number of dice displaying the same category number. For example, if you roll three 3s and choose the 3's category, your 3's score will be 9. If you roll fewer than three 3s, don't use that turn for the 3's category unless you have no better choice. A total score of 63 or more for aces through 6s entitles you to a 35-point bonus.

The categories in the lower half of the scoring area can be satisfied with any numbers; it's the configuration of the dice that counts. For three and four of a kind, you need at least three or four dice of the same number, but all five dice are totaled in the score. A full house—three dice of one number and two of another—is worth a flat 25 points. Small and large straights are runs of four and five dice, respectively, and score 30 and 40 points. If a large straight is used as a small straight, it counts only the 30 points.

The Yatzy category is five of a kind, and it earns a whopping 50 points. Chance, which just totals all five dice, is the last-resort cat-

egory where you can use a roll that doesn't fit anywhere else. You'll probably wish you had more than one chance to use Chance!

STRATEGY

Yatzy is a game of strategy as well as luck. The strategy lies both in choosing which dice to reroll and in deciding which scoring category to use for each turn. Of course, you'll hope to get good scores in all 13 categories in each game, but this is often impossible, so you may have to settle for low scores or zeroes in some categories.

If you decide to take a zero or low score in the upper half of the scoring area, place it in the aces category if you can, to avoid jeopardizing your bonus. The few points lost can probably be made up elsewhere.

The best category in which to take a zero in the lower half is, surprisingly enough, Yatzy; although it brings in a high score, chances are substantial that you will never roll a Yatzy. The large straight and four of a kind are also good candidates for zeroing, because they're hard to roll.

Note that your subtotals for the upper and lower halves of the scoring area and your grand total are all updated after each score is entered. Also, at the start of a game, your previous high score is displayed at the top of your score column.

RUN it right: **C-64; C-128**

The Multitasking Factor

By Jim Butterfield

CAN A SMALL COMPUTER do two things at exactly the same time? No, but sometimes it can seem to be doing just that. For example, while it's waiting for input from the keyboard, it can be performing another task.

That's exactly what happens in this article's Basic program, Factors. As you enter a value, the computer has little to do except wait for you to type, so it spends the time calculating prime numbers.

When you finish typing and press the return key, these primes will speed the job of calculating the number's factors.

This kind of activity—doing two things almost at once—is called "multitasking" and actually happens all the time on your Commodore. For example, no matter what else the machine is doing, it also checks the keyboard and updates the clock sixty times a second. It does this through an "interrupt" routine, which stops the program you're running, performs these special tasks and then resumes the main job. If you think about it, you'll see that your program is slowed down a little by this activity.

With Factors, nothing has to be stopped; the computer calculates prime numbers during the time it's waiting for you to type, when it would otherwise be idle. Once you press return to signal that the number is completely entered, the machine goes to work full-time on the factoring job.

After you enter a number, the computer displays how many prime numbers it has calculated so far. If you typed quickly, there won't be many, but the computer will use the ones it has. If it uses all the values in the prime table and still hasn't found all the factors, it continues the process using a sequence of odd numbers as trial divisors. For example, if it knows that a number isn't divisible by 3, it can be sure the number can't be divided by 33 either. The odd-number method is less efficient, but it still works.

As Factors runs, it gets "smarter" and speeds up, because the table of prime numbers gets bigger. Numbers containing only small factors are always handled quickly—the table of primes is hardly needed. Numbers containing large factors are processed slowly at first, but more and more quickly as the table of primes grows.

A good number to try to see this effect is the easy-to-remember 123456789. Try it as soon as you start running Factors and again a few minutes later; the speed improvement will be quite noticeable. After about 500 prime numbers have been calculated, the computer will have all it needs to find the factors of 123456789, and there will be no further speed improvement. However, it will continue to enlarge the prime table, up to a maximum of 3400 numbers, for handling other numbers you might input for factoring.

Don't enter a number that contains more than nine digits, because Basic can't hold numbers greater than that with precision, and the factors the computer generates will almost certainly be wrong. Computer experts try to explain such phenomena with jargon like "a 32-bit mantissa," but what they mean is, stop at nine decimal digits.

That's why the table of prime numbers stops at 3400: The toughest nine-digit number won't need more than that.

Program Notes

Perhaps you're writing a program where the computer could do useful work while waiting for keyboard response. Look through Listing 1 and refer to Table 1 to see how it's done.

The Factors code is divided into four sections: lines 100–170 start things up; 180–290 calculate the primes and enter them into the table, called P( ); 300–460 check for keyboard input; and 470–710 factor the input value.

The trick to multitasking in this case is the Get statement. If the program were to ask for numbers using an Input statement, there would be an enforced wait until you pressed return. By using Get, it can spot when the keyboard is quiet and use the time to do more calculation. Since Get obtains one keystroke at a time, Factors must string the keys together to make the whole input number. This is done with concatenation in line 410.

The Get routine is inside a bigger looping structure that calculates the prime numbers and puts them in table P( ). This outer loop is set up in such a way that Get is checked frequently, so you won't see any hesitation by the computer when you press a key. When you hit the return key, factoring continues until it's complete; no more primes are calculated until the requested work has been done.

The resulting factors are displayed in a convenient format. When the same factor appears more than once, it's shown as raised to a power (variable K holds the power). Multiplication is indicated by an asterisk—the Basic standard. If you'd rather see an X for multiplication, just make the appropriate change in line 640.

Speed Tricks

Factors is designed with a number of features that increase program speed. For example, array P( ), which holds the table of prime numbers, takes up a lot of memory space—over 17K, in fact. That's no problem as to memory availability, but there's a sneaky speed question. If you create an array and *then* create new Basic variables, the array must be moved over to make room. If the array is very large, like P( ) in this case, there'll be a pause while we move this massive chunk in memory. In Factors, I avoided this by defining all the variables—with the DIM (Dimension) statement in line 110—*before* defining array P( ).

Of course, a DIM statement is normally used to set up arrays, but it can also create variables and assign them locations in memory. By the time P( ) is created with the DIM statement in line 130, all the variables are in place, and there's no need to waste time relocating the array.

Another speed trick involves putting the variables that are used most often at the beginning of the variable table. You do this by using them early in the program. In Factors, the DIM statement in line 110 creates variables P3 and P4 first, since they're used often in calculating factors.

FAST ENOUGH?

Other languages—particularly machine language—can calculate factors faster than Basic and can handle larger numbers with precision. However, Factors, written in Basic, is quite usable and illustrates how to write a program that emulates multitasking.

Now, any time you're writing a program that needs to wait for user input, think about using the idle time for another job. Perhaps the computer could partly sort a table of names of values or calculate averages. Basic is flexible and fun, and multitasking is just one more example of what it can do for you.

Table 1. Program references.

Important lines:

190—A new prime value is entered into the prime table here. Reached from line 290.
220—Chooses a new number for testing as a prime. Reached from line 270.
250—The "main loop." Tries a new divisor for the number being tested as a prime. Reached from line 730, if the table of primes isn't full.
310—Tests for input from the keyboard. If the table of primes is full, execution returns here from line 740.
360—Prints the prompt character on the screen. The program loops back here from lines 430 and 460 after it has detected and displayed a valid character.
370—Checks for a new keypress. Line 310 scoots ahead to this point if the prompt message has already been printed.

440—Execution comes here if the delete key is detected at line 390.
480—If the return key is detected at line 380, the program comes here and starts calculating factors.
550—Tries a new factor. Execution loops back here from line 670.
580—Does the trial division. The program skips ahead from line 550 if it has exhausted the prime table, and it loops back from line 590 if the factor is "operational," to see if it has been used more than once.
670—Decides if it's worth trying more factors. Line 600 sends execution here if a trial factor fails.
730—Decides whether to go back for more primes. The program leaps down here from lines 370 and 400 if there's nothing interesting happening on the keyboard.

Variables:

Whole program:
P( )—Table of prime numbers.
P9—Maximum size of the prime table.
PN—Number of primes in the prime table.
P8—Value to be tested as a prime.
P1—Entry in prime table to try as a factor for a new prime.

Prime calculation:
P2—Trial factor for a prime test.
P3—Quotient from trial division.

Input section:
N—Zero if prompt hasn't been sent.
N$—Input keys detected so far.
X$—Current key detected.

Factor calculation:
N—Number to be factored.
K—Power to which a factor is raised.
P2—Trial factor for factoring test.
P3—Quotient from trial division.
P4—Entry in prime table to try as a factor.
X$—Separator character for the result.

RUN it right: **C-128**

Amazing!

By Harold Bjornson

HAVE YOU EVER WISHED your C-128 had some of the more advanced commands and features available on the ultra-expensive personal computers? Perhaps more colors and faster disk access? Even multitasking? Sound too good to be true? Well, wish no longer.

After spending the last two years working with my trusty assembler, I have come up with the most advanced machine code utility ever seen on a C-128. Totally menu-driven and self-contained, it is so easy to use that written instructions would be superfluous and just get in the way, so I didn't even bother with them.

To activate the program, just type RUN "AMAZING" or load it from Menu 128. The program works in 40- or 80-Column mode, but I would suggest you use 80-Column Fast mode, if possible. Have fun and enjoy!

RUN it right: **C-128 (40-Column mode); joystick**

Crabbie

By Leonard Morris

CRABBIE IS AN ARCADE-STYLE cat-'n'-mouse, or, more descriptively, octopus-'n'-crab game that's less complicated than Rubik's cube and more versatile than Pac-man. It's designed for the C-128 and a good joystick.

Crabbie is a blue crab that eats the pebbles lying on the maze-like floor of the ocean. However, there are reddish-brown octopi that live in the same area, and they just love crab meat. You play the game by moving your crab—with the joystick plugged into port

#2—so that it avoids the four hungry octopi while gobbling up as many pebbles as possible to gain points.

Once an octopus grabs your crab, it's dead meat, but is immediately reincarnated somewhere else, and the chase continues. Your crab has four lives to lose (plus a fifth if your manage to accumulate 10,000 points) before the game ends.

The initial title screen displays the top five scorers so far (saved to disk from previous games) and your choice of skill levels: Expert, Semi-pro or Novice. The number of points you receive for each pebble your crab eats depends on the skill level of play: 10 for Novice, 15 for Semi-pro and 20 for Expert.

You can also take advantage of starfish that appear in the corners of the screen—three at the Novice level, two at the Semi-pro and only one if you've chosen to be an Expert. If your crab gets cornered and eats a starfish, the octopi will turn green and freeze in place for a few moments so you can escape, for then your crab can go right through them and survive. The octopi will also be halted and turned green if you press the firebutton, but you should save this measure for dire emergencies, since you can do this only once during each crab-life.

The colors and patterns of the maze change with each game, and the more than 4000 possible combinations present an almost endless variety to challenge your reflexes and joystick skill. You'll find your crab has got to be very agile, for those octopi are fast and hungry and tend to gang up on poor little crabs.

RUN it right: **C-64; joystick**

Kidnapped!

By Christopher Jones

WANT TO IMPRESS YOUR FRIENDS? There's no better way than to rescue them from aliens who've locked them in an underground maze! You can accomplish this amazing task with Kidnapped!, a one-person game that uses the C-64's graphics and sound capabilities to produce action that's fun and exciting.

The scenario of Kidnapped! is simple. Aliens from another planet have grabbed your friends and hidden them behind doors in a subterranean maze. You must use a character controlled by a joystick in port 2 to rescue them all within two minutes, or the maze will explode.

The maze has seven doors, six opening into hiding places and the last, a black one, leading to the outside. Scattered throughout the maze are keys needed to open the doors. Move your character over a key so he can pick it up, then move him next to a door and press the joystick button. The door will open, and, if a friend is there, he or she will step out. After finding all your friends, exit through the black door. Note that you can carry only one key at a time, and you mustn't move the joystick while pressing the button or the button-press might not register.

Now for the Hard Part

If all this sounds too easy, you're right—lurking in the maze are alien guards, ready to capture you if you run into them! Also, the doors, keys and guards are in different places each time you play.

Kidnapped! has three difficulty levels, chosen from a menu. At the beginner level, six stationary aliens guard three of your friends. At the intermediate level, four friends are guarded by nine aliens, one of which is roaming the maze to find you. At the advanced level, 12 aliens, two of them moving, guard five friends.

To improve your chances of success, try to plan your route in the maze while the computer is setting up the game. Also, open doors with nearby keys if possible; don't waste time fetching keys that are far away. Finally, stay as far as you can from the moving guards.

Customizing Play

There are several ways to change the program to make playing Kidnapped! more enjoyable. If you want more or less time to rescue your friends, change the value of variable TI$ in line 235. Lines 795, 800 and 805 control the number of friends and stationary aliens on the screen at the three levels, and you can change the latter by adjusting the values of variable M. Don't change the values of N and LL; they are the level number and number of friends, respectively.

You can make your character move faster or slower at the beginner level by changing the value of I in line 410; decrease it for faster and increase it for slower. Remember, though, that this works only at the first level. ■

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Replacements will not be made if the disk has been altered, repaired or misused through negligence, or if it shows signs of excessive wear or is damaged by equipment.

The programs in ReRUN are taken directly from listings prepared to accompany articles in *RUN* magazine. They will not run under all system configurations. Use the RUN It Right information included with each article as your guide.

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